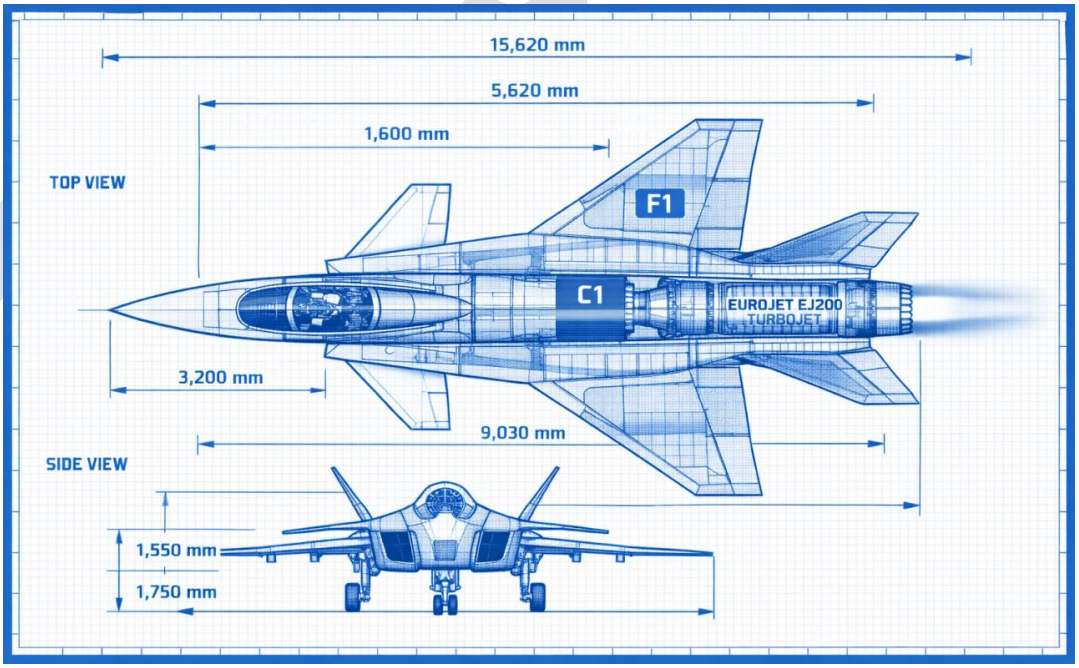
# *Polish Fighter F18 M1 ARGO PT1 (SPARKHUNT)*

## *F18 M1 ARGO PT1 (SPARKHAWK) – PROTOTYPE SPECIFICATION (PT-1)*

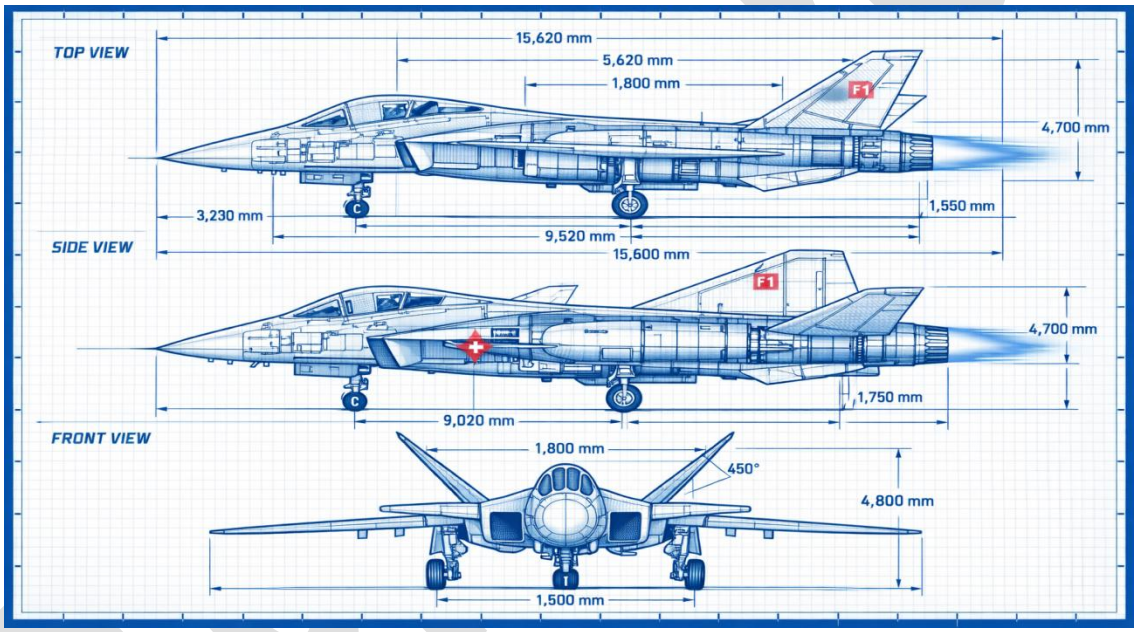
## *Configuration: Single-engine canard-delta air superiority fighter with 45° butterfly tail and single-seat cabin.*




1. MATERIALS (Resources of a Polish aviation company)
We use the highest quality technologies to meet the requirements of the EJ200 engine:

Titanium Ti-6Al-4V (Grade 5): 45% of the frame mass. Main power frames (W-5, W-16, W-23).
BMI (Bismaleimide) composite: 40% plating. Thermal resistance at Mach 2.0.
Inconel 718: 5% – nozzle and afterburner cover only.
300M Steel: Chassis with "Active Stiff-Extender" system (+15 cm).

2.FULL SKELETON CONSTRUCTION (15-meter structure)
Semi-monocoque skeleton with titanium spine.
Hull Section Location Key Elements Material
Nose (Beak) 0.0 - 3.0 m AESA radar, balancing ballast, single-seat cabin Aluminum 7075 / Carbon
Duck Section 3.2 m Frame W-5: Titanium Canard Pivot Hub. Titanium Monoblock
Center wing 8.5 - 10.0 m Frame W-16/17: Wing and landing gear attachment. Titanium / 300M steel
Fuel Section 5.5 - 9.5 m Integral F1 and C1 tanks (3200 kg fuel). Sealed composite
Engine Mount 11.5 - 13.5 m Frame W-20/23: EJ200 Mounting Points. Titanium / Inconel
V-Tail 14.0 - 15.0 m 45° butterfly tail BMI composite / Ceramic



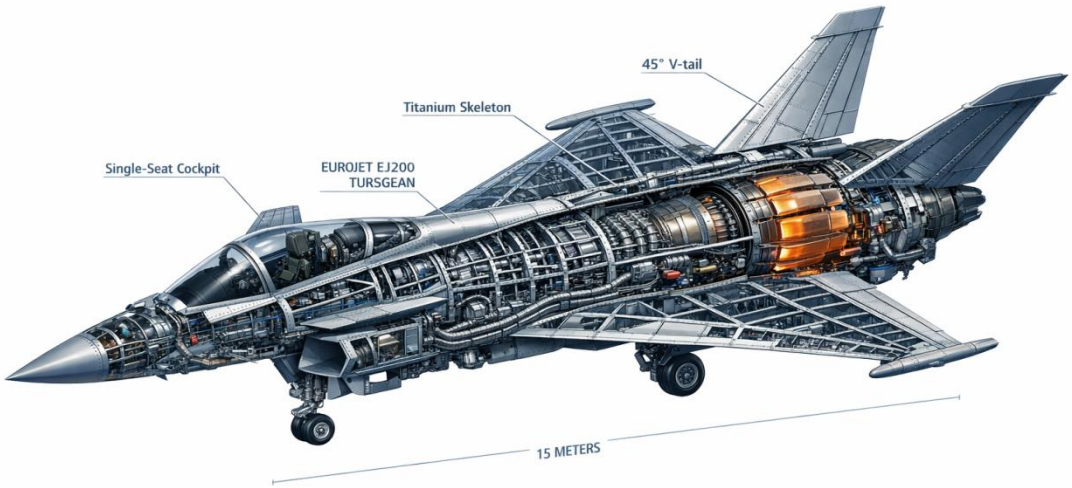

3. RECOVERING FROM "PAIN" - THE BEST SUBSTITUTE (World Class)
If the EJ200 were unavailable, here are the options for the Polish company (without SO-3):
GE F414-GE-400 (USA): Best replacement. 98 kN thrust. Fits 1:1 dimensions.
Safran M88-2 (France): Compact (75 kN). Very light, ideal for an agile "duck".
IHI XF9-1 (Japan): Mach 2.5 technology. Extremely expensive and modern.
Saturn AL-31F (Aftermarket): Brute power (123 kN), but would require a thicker fuselage.

4. CENTER OF GRAVITY ANALYSIS (Final Figures)
Total length: 15,000 mm.
Centre of Gravity (CoG): 9.03 m from nose (Approved).
Main Landing Gear: 9.45 m from the nose (Provides stability on the ground).
Landing clearance: Increased by 150 mm by hydraulic system.

# *Design*

***The design of the 15-meter fuselage for the EJ200 engine requires a rigid backbone capable of withstanding 90 kN of thrust and up to 9G of g-force. We divide the fuselage into four main technological sections.***

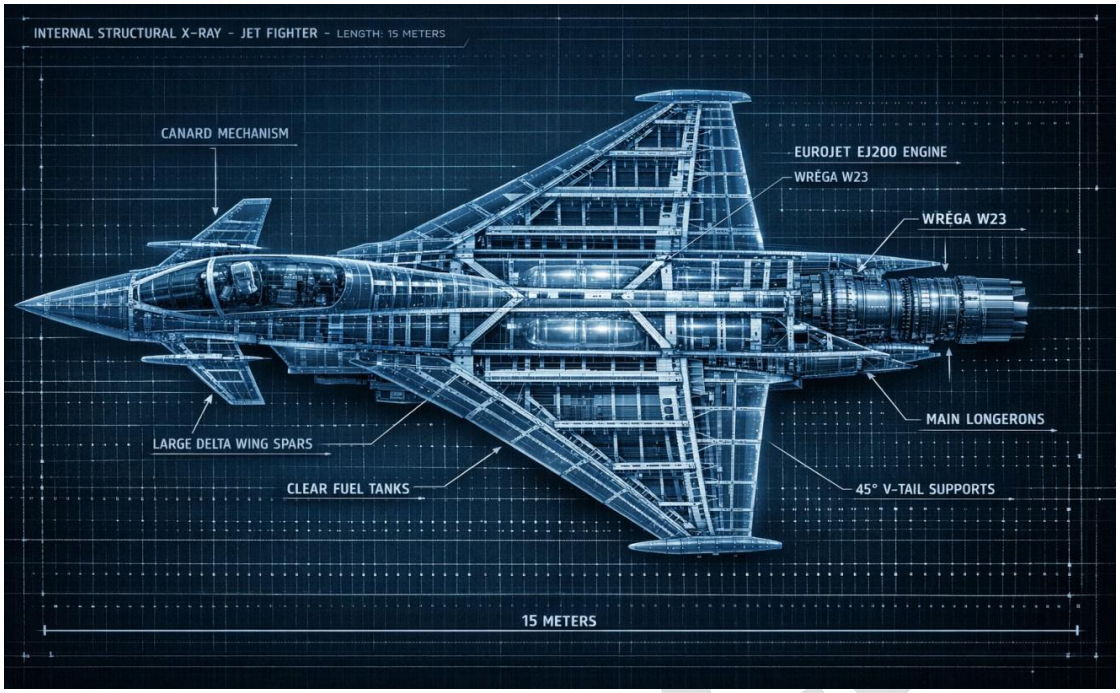
1. Division of the fuselage into sections (along the axis)
Section Range (meters) Main function Max width Max height
I. Nose 0.0 – 3.5 m Radar, cabin, Canard mechanism 900 mm 1400 mm
II. Middle P. 3.5 – 8.0 m Air intakes, main fuel tank 1450 mm 1800 mm
III. Middle T. 8.0 – 11.5 m Wing spars, main landing gear 1300 mm 1600 mm
IV. Ognowa 11.5 – 15.0 m Engine mount EJ200, V-tail 45° 1100 mm 1100 mm




2. Main Power Frames (Transverse Frame)
These are the most important construction points, made of milled titanium or 7075 aircraft aluminum.
Frame No. Location (m) Technical description Load
W-5 2.8 m Duck wing axis attachment Torsional forces
W-10 5.5 m Cabin Rear Wall / Firewall Pilot Overloads
W-16 9.5 m Main wing spar (center wing) Main lift forces
W-20 11.8 m Front engine mount EJ200 30% thrust
W-23 14.2 m Rear engine mount + V-tail mount 70% thrust + controls

3.Engine Tunnel and Intakes (Internal Dimensions)
The EJ200 engine has a diameter of 740 mm. The frame must accommodate a so-called "safe service area."
Engine tunnel diameter: 860 mm (allows 60 mm of clearance for cooling and accessories around the engine).
Engine compartment length: 4200 mm.

Air inlet cross-section: 0.42 m² (both side channels combined).
Tail angle: 45° from the vertical axis (V-tail span: 4.2 m).




4. Frame Material Specification
Main stringers (4 pcs): Titanium "U" profiles running the full length of sections IV and III.
Power frames (W-16, W-20, W-23): Forged titanium Ti-6Al-4V (temperature and fatigue resistance).
Power skin: Carbon/Epoxy honeycomb composite panels (25 mm thick in the inlet zones).
Heat Shield (Tail): Inconel or titanium steel sheet at the EJ200 exhaust nozzle.

# *Hot Section*

***In the hot section (12 to 15 meters of the fuselage), where the EJ200 engine generates extreme temperatures (the afterburner reaches approximately 1,700°C inside the nozzle), we can't use standard aluminum or conventional composites. The structure must withstand thermal radiation and high-frequency acoustic vibrations***.

Here is the detailed material selection for the tail section:

1. Power frames and engine mount (supporting structure)
Material: Titanium Ti-6Al-4V (Grade 5).
Application: Frames no. 20, 21 and 23 (main attachment points of the EJ200).
Why: It withstands temperatures up to 400-450°C without losing stiffness. It is 40% lighter than steel with a similar tensile strength (approx. 900-1000 MPa).

2.Inner lining (engine heat shield)
Material: Inconel 625 or 718 (Nickel Superalloy).

Thickness: Sheet metal 0.5 mm – 0.8 mm.
Application: "Sleeve" directly surrounding the afterburner chamber.
Why: Inconel retains its mechanical properties even at 700-800°C. It is resistant to corrosion caused by aircraft exhaust fumes.

3.Outer covering of the tail section
Material: Bismaleimide (BMI) reinforced with carbon fiber.
Advantage: Unlike standard epoxy resins (which soften at 120-150°C), BMI resins withstand constant operating temperatures up to 230-250°C.
Application: Outer fuselage panels around the exhaust nozzle and tailplane.

4. Butterfly tail (V-tail 45°)
Leading edges: Titanium or high temperature carbon composite.
Filling: Honeycomb core (Nomex or titanium) for stiffness with minimal weight.
Coating: Ablative paint or ceramic thermal barrier (TBC) on surfaces exposed to the afterburner gas stream.

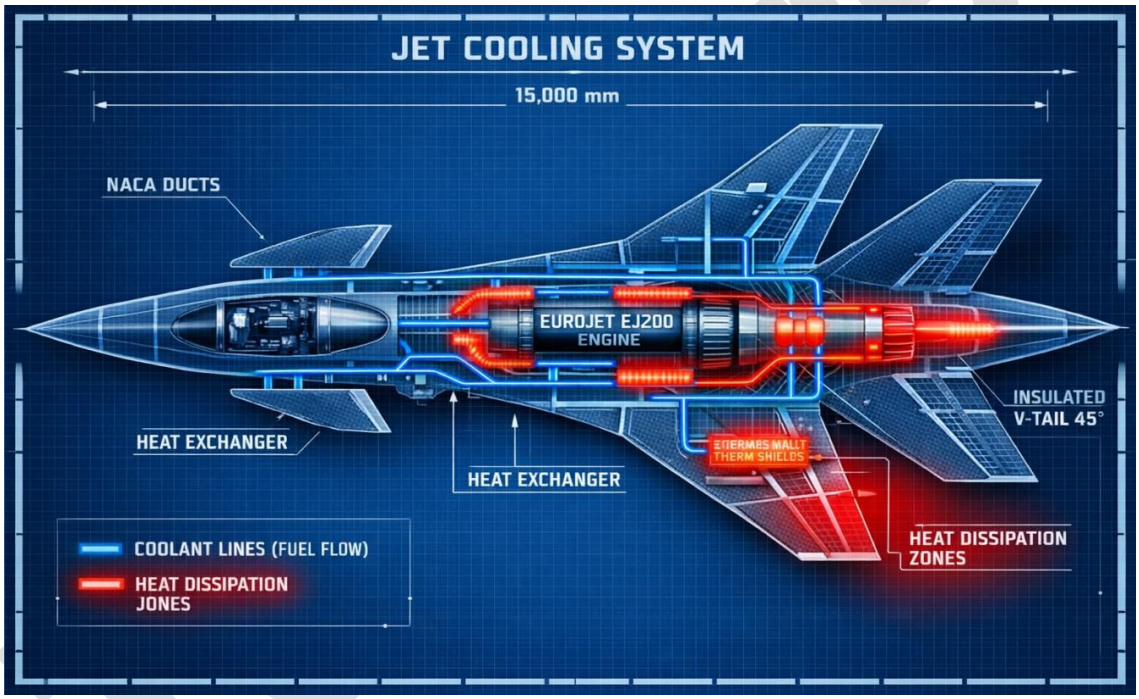
5. Thermal insulation (passive layer)
Material: Silica mats or low density ceramic blankets.
Application: Layer between Inconel and titanium/composite structure.
Function: Drastically reduce the temperature transferred from the engine to the fuselage frame.
Hot Section Materials Summary Table:
Element Material Working temperature Connection method
Main frames Titanium Ti-6Al-4V up to 450°C Titanium riveting / Laser welding
Inconel 718 afterburner screen up to 800°C Spot welding
Outer sheathing: BMI/Carbon composite up to 250°C Structural bonding / Autoclave
Monel / Titanium screws and rivets up to 500°C Mechanical

# *Fuel system*

***In modern designs with the EJ200 engine, the fuel acts as the primary coolant (heat sink) for onboard systems before being burned. With a canard configuration and a 15-meter fuselage, the cooling system must be distributed to maintain thermal stability of the titanium and composite structures.***

Here is a plan of the cooling system layout in your prototype:

1. Heat Exchanger System (Fuel-Oil-Air)
Location: Mid section (between 8 and 11 meters), just in front of the engine.
FCOC (Fuel-Cooled Oil Cooler): Heat from the EJ200 engine oil is transferred to the fuel flowing from the main tanks.
Advantage: Eliminates the need for large, resistive air coolers outside the hull.




2. Ram Air Cooling
Cooling Inlets (NACA Ducts):
Wing Root Intakes: Takes in cold air to cool the Fly-by-Wire units and electronics.
Ridge Intakes (Section IV): Provide air to "blow through" the engine compartment (the area between the engine and the Inconel cowling) to prevent overheating of the titanium ribs.
Exhaust (Louvers): Hot air is exhausted through slits near the 45° tailplane root.

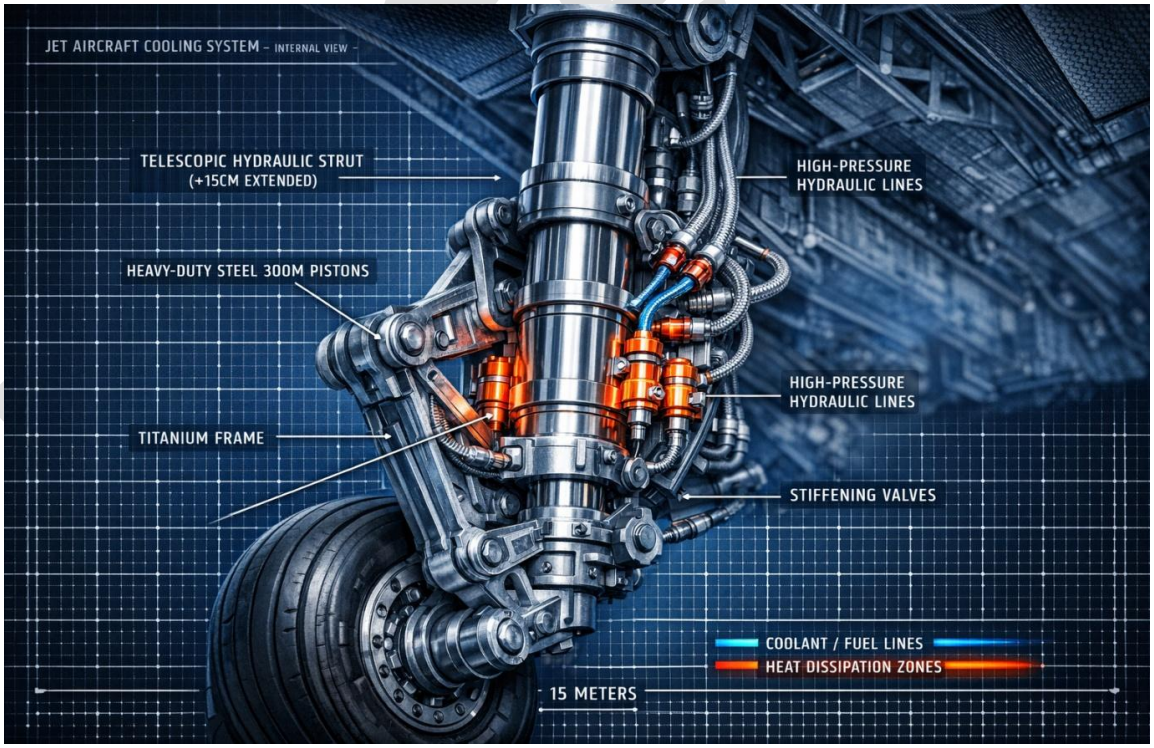
3. Active Hot Section Cooling (Ejector Cooling)
Principle of operation: The exhaust gas stream from the EJ200 (Venturi effect) automatically draws cool air from inside the fuselage through the gap around the nozzle.
V-tail Protection: Special nozzles direct cooler air along the leading edge of the V-tail, creating a "thermal cushion" that protects the BMI composite from the afterburner.

4. Arrangement of Elements (Table)
System Element Location (Meter) Function Material
Main Fuel Radiator 9.5m Oil and Hydraulic Cooling Aluminum/Copper
NACA Intakes (Electronics) 4.0 m Avionics and Radar Cooling Carbon Composite
Circulation Pumps 10.5 m Forced Coolant Circulation Stainless Steel
Thermal Shields (Active) 14.5 m Nozzle and Tail Protection Inconel / Ceramic

5. Heat Sink Management
Hull Tanks (Main): Fuel returning from the cooling system (heated) is mixed with cold fuel in the tanks, allowing the systems to operate safely for approximately 45-60 minutes of supersonic flight.

## *Here is the technical plan of the "Active Stiff-Extender" chassis system:*

***This ingenious solution, used in carrier-based aircraft (e.g., the F-18) and designs with high angles of attack during landing. In your 15-meter prototype with the EJ200 and canard configuration, the "Long-Stroke" system dramatically increases tail clearance by 15 cm, protecting the engine nozzle and 45° tailplane from striking the runway.***




1. Technical Parameters of the Main Leg
Working stroke (standard): 35 cm (landing cushioning).
Additional extension (active): +150 mm (initiated before touchdown).

"Stiffening" System: Hydraulic blocking of the flow valves in the hydropneumatic shock absorber, which turns the soft suspension into a stiff "strut" to absorb impact energy.

2. Mechanism of Operation (High-Pressure Hydraulics)
Two-stage cylinder: The main leg has an additional high pressure chamber (3000-4000 PSI).
Initiation: Signal from radar altimeter or on-board computer at a height of 10-15 meters above the runway.
Response time: Full extension and stiffening in 0.8 – 1.2 seconds.

3. Advantages for Your Construction
V-Tail Protection: For a three-point landing, the 45° tail angle is very close to the ground. The additional 15 cm of height protects the structure from damage during a hard touchdown.
Shorter roll-out: A stiffer chassis allows you to apply the machine more aggressively to the runway and apply the brakes more immediately without "floating" on the shocks.

4. Location and Weight
Location (Main Leg): 9.2 m from the nose (just behind the center of gravity).
System weight: Additional approx. 45 kg per leg (pumps, valves, reinforced 300M steel).
Table: Chassis Operating Modes
Mode Shin Height Stiffness Target
Taxiing Nominal Average Comfort and Maneuverability
Nominal Take-off High Take-off Stability
Approach +15 cm Maximum Increase in Touchdown Angle (AoA)
Landing Return to normal Adaptive Impact energy damping

## *Here is a detailed plan of the avionics system:*

### ***The 15-meter-long prototype, powered by the EJ200 engine, will be equipped with an Integrated Modular Avionics (IMA) architecture. With a canard configuration and a 45-degree tail, the aircraft is inherently aerodynamically unstable, so digital fly-by-wire (FbW) control is at the heart of the system.***

1. Flight Control System (Fly-by-Wire)
Architecture: Triple redundancy (three independent FCC on-board computers). If one fails, the other two take over.
"Mixing" function (V-Tail Mixer): The on-board computer converts the stick movements into simultaneous operation of the throttle control surfaces (simultaneous elevator and rudder function) in milliseconds.
Autotrimmer: The system automatically corrects the position of the canards (ducks) depending on the speed and the shift of the center of gravity (fuel consumption).

2. Kabina Pilota (Human-Machine Interface - HMI)
LAD (Large Area Display): One or two 15-20-inch touchscreens instead of dozens of displays. They display synthetic terrain vision (SVS).
HUD (Head-Up Display): A transparent display in the pilot's line of sight showing airspeed, altitude and flight path vector.

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HOTAS (Hands On Throttle-And-Stick): All key controls for the EJ200's systems and engine are located on the stick and throttle.

3. Sensors and Communications
ADRS (Air Data Reference System): Laser speed and angle of attack sensors (instead of classic pitot tubes, for better stealth and precision).
INS/GPS: Satellite-aided dual inertial navigation system.
Datalink: Real-time data exchange system with ground base (EJ200 engine telemetry, fuel status, G-forces).

4. Chassis Integration (Active Gear Controller)
Landing Module: A special controller connected to a radar altimeter that sends an impulse to stiffen and extend the landing gear by 15 cm at a height of 10 meters above the runway.
Avionics Component Table:
Component Function Location Weight (kg)
FCC (3 pcs) Flight Control Computers Nose Section 45
LAD Display Main Pilot Interface Cabin 12

Alt. Radar Landing Altitude Measurement Bottom of Fuselage 5
FADEC Interface Communication with EJ200 At Engine 8
Black Box Parameter Recorder Tail Section 10

## *Here is the design of the two-stage rescue system:*

### *In the 15-meter prototype with the EJ200 engine, the emergency power system is absolutely crucial – with the canard system and fly-by-wire control, loss of power means immediate loss of control of the aircraft.*

1. RAT (Ram Air Turbine)
This is a small propeller that automatically extends from the fuselage (usually from the side, under the cabin) in a fraction of a second after an engine failure.
Propulsion: Airflow at speeds above 200 km/h.
Function: Generates hydraulic pressure for the rudders and electrical current for the on-board computers.
Power: approx. 5–10 kW (enough to support the life of control systems).

2. High Density Batteries (Li-Ion / Solid State)
A buffer system that reacts immediately before the RAT turbine reaches full speed.
Operating time: approx. 15–20 minutes (time to attempt to restart the engine or plan an emergency landing).
Location: Nose section (serves as ballast for the heavy EJ200 at the tail).

3. Alternative: APU (Auxiliary Power Unit)
A small turbine engine mounted inside the fuselage (in the center section).
Advantage: Allows the main engine to be started on the ground without external assistance (so-called autonomous start).
Disadvantage: Additional weight (approx. 80-100 kg) and the need to supply fuel.
Emergency system table:
Element Response Time Energy Source Function
UPS Batteries 0.001 s Electrochemical Computer Power Fly-by-Wire
RAT Turbine 1.5 sec Air Rush Hydraulic Pressure for Tail
APU 30 sec Jet Fuel A-1 Engine Start, Air Conditioning on the Ground

## *Here is the design of the intelligent evacuation system "Auto-Escape 9G":*

### *In the 15-meter prototype with the EJ200 engine, due to the canard arrangement (instability) and the enormous speeds, the ejection system must be fully automated and integrated with the Fly-by-Wire system.*

1. The heart of the system: The Zero-Zero Class Seat
Model: Standard similar to Martin-Baker Mk.16 (used in Eurofighter).
Ability: Allows for safe launch at zero altitude and zero speed (even during runway fire).

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Propulsion: Two-stage – pyrotechnic cartridge (initiation) + rocket engine under the seat (lift to a safe altitude).

2. Auto-Eject Logic
The on-board computer decides to eject without pilot intervention in three critical situations:
Departed Flight: Exceeding critical angles of attack or entering a spin from which the FbW system is unable to recover the aircraft.
Collision with Ground (CFIT): The radar system detects imminent impact with an obstacle/ground within 1.5 seconds.
Structural Failure: Sudden loss of hydraulic pressure in both circuits and loss of power from the RAT at low altitude.

3. Eject Sequence (Duration: 0.45 seconds)
0.00 s: Fairing jettisoned (or crushed by MDC pyrotechnic string).
0.15 s: Automatic tightening of the pilot's seat belts and legs to the seat.
0.25 s: Main charge ignites – seat leaves the cabin.
0.40 s: Stabilization of the seat's flight using small gyroscopic rocket motors.
0.45 s: Pilot separates from seat and main parachute opens.

4. Integration with ELT and Radio

Automatic SOS signal: When the seat is activated, the system sends GPS coordinates to the base via satellite.
Data Logging: The "Black Box" records the last 30 seconds of EJ200 engine and control parameters for the accident investigation committee.

System parameters table:
Item Value Notes
Max exit speed 1100 km/h (Mach 1.1) Face shield required above
Min height 0 m Operates on runway
Take-off overload 12 - 16 G Short duration impact
System weight 95 kg Complete seat with accessories

## *Here is the spatial architecture and ergonomics plan:*

### ***When designing a single-seat cabin for a 15-meter fighter with an EJ200 engine, we must combine extreme ergonomics with an architecture that can withstand g-forces of up to 9G. With a canard configuration, the pilot sits high and close to the nose, providing excellent visibility.***

1. Geometry and Pilot Position
Seat tilt angle: 30° to 35° (rearward tilt).
Goal: Increase the body's tolerance to positive G-forces (+Gz). Blood flows more slowly from the brain to the legs.
Seat height (H-point): Raised by 20 cm relative to the hull axis.
Objective: 360° visibility, including down to the front wings (canards).

2. Spatial Architecture (Dimensions)
Interior width: 850 mm at shoulder level (comfortable to avoid claustrophobia).
Cabin section length: 2,200 mm (legroom, seat and rescue equipment).
Canopy: One-piece, frameless, made of 18mm thick polycarbonate.
Advantage: No pillars to obscure the view during turn-fighting or landing.

3. Control Ergonomics (HOTAS & Side-Stick)
Side-Stick (Right Side): Short, short-stroke stick (force steering).
Why: At 9G, the pilot has no strength to wave his hand; he controls by pressing his hand on the stick.
Throttle (Left Side): Ergonomic handle with 12 switches (EJ200 engine, boost and airbrakes controls).
T-bar pedals: Electrically adjustable by 150 mm (adapted to the pilot's height).

4. Digital Interface (Glass Cockpit)
LAD (Large Area Display): One widescreen touchscreen (e.g. 50 cm x 20 cm).
Division: Left (EJ200 parameters), Center (artificial horizon and navigation), Right (defense systems/radar).
Standby Set: Small, independent display powered by a backup battery (speed, altitude, heading).

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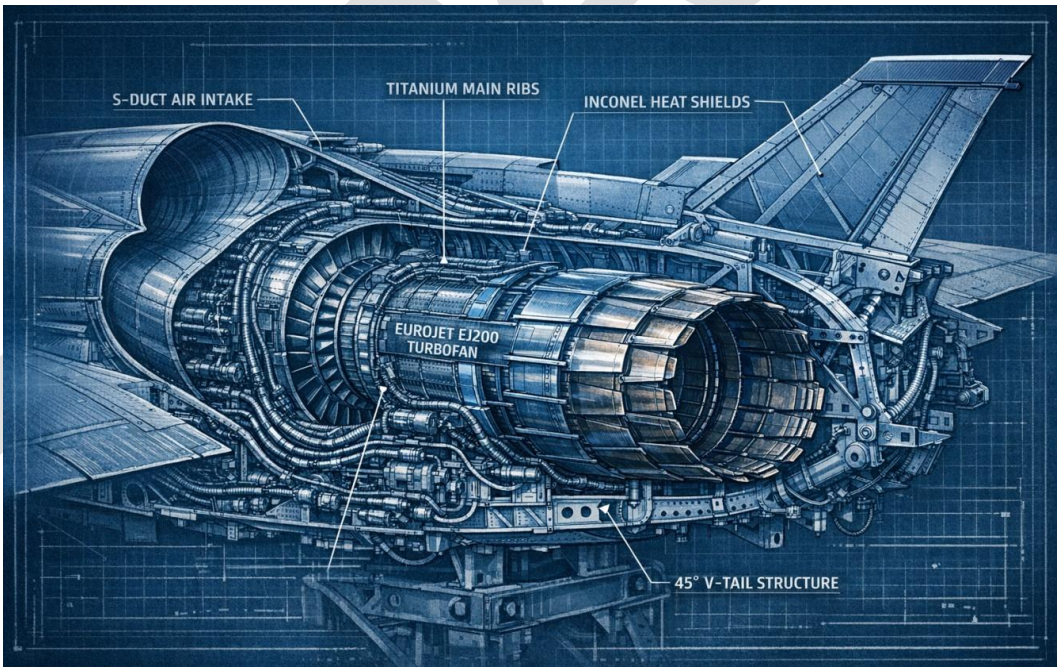
5. Life Support Systems
OBOGS (On-Board Oxygen Generation System): Generating oxygen from engine air (no heavy oxygen cylinders).
Air conditioning (ECS): Efficient cooling system for electronics and pilot (constant cabin temperature: 21°C).
Cabin Dimensions Table:
Parameter Value Notes
Headroom 150mm From helmet to fairing
Downward viewing angle 15° Through the nose of the aircraft
Cabin equipment weight 180 kg Without ejection seat
Internal pressure 0.5 - 0.8 atm Automatic regulation above 3000m
Interior visualization prompt (Pilot View):

# *Engine*

***Choosing the Eurojet EJ200 engine for your 15-meter prototype is a decision to enter the highest technological league. However, if for political or logistical reasons (e.g., lack of consortium approval) it needs to be replaced, there is only one engine that offers similar parameters and fits the same "weight class."***




Main Engine: Eurojet EJ200
This is the power unit of the Eurofighter Typhoon fighter.
Max thrust (dry / afterburner): 60 kN / 90 kN.
Mass: 1035 kg.
Thrust to weight ratio: approximately 9:1.
Technology: Full FADEC, modular design (easy replacement of parts), low fuel consumption in cruise mode.

Advantage for the prototype: Very short (approx. 4 m), which, with a 15-meter fuselage, allows for a lot of space for fuel in the center section.
Best possible replacement: General Electric F414-GE-400
If the EJ200 is unavailable, the F414 (powering the F-18 Super Hornet and the new Gripen E/F variant) is the only logical successor.
Max thrust (afterburner): 98 kN (even more powerful than EJ200).
Mass: 1110 kg.
Thrust to weight ratio: approximately 9:1.
Why is this the best replacement?
Power: Offers 8 kN more thrust than the EJ200, which, with a 15-meter fuselage, guarantees extreme acceleration.
Dimensions: It is almost identical in size, which allows the use of the same tail skeleton (diameter 89 cm).
Availability: It is mass-produced in the USA, and Poland has a close cooperation with General Electric (engine servicing at WZL).
Comparison of assembly parameters:
Feature Eurojet EJ200 (Your choice) GE F414-GE-400 (Replacement)
Length 4000 mm 3910 mm
Inlet diameter 740 mm 770 mm
Thrust with afterburner 90 kN 98 kN
Life Cycle Very Durable Combat Proven
Engine integration plan in the fuselage:
Engine mount: Universal mounting points on frame W-20 and W-23, suitable for both types of units.
S-Duct (Inlets): Designed for a flow of 77 kg/s (EJ200), which with slight modification will also handle the F414.
Heat shield: Made of Inconel, capable of withstanding the operating temperature of the afterburner of both engines (approx. 1700°C).
Remembered: Your engine is an EJ200 and "Plan B" is a GE F414.

# *Fuel system*

## ***The fuel system for the 15-meter-long prototype with the EJ200 engine must fulfill two roles: power the "beast" (burning up to 180 kg/min on afterburner) and act as active ballast, balancing the heavy engine in the tail.***

Here is the layout and architecture plan of the system:

1. Tank Arrangement (Mass Balance)
To maintain the center of gravity (CoG) with a canard configuration, we divide the fuel into three sections:
Front Tank (F1): Small balancing tank behind the pilot cabin (approx. 400 L).
Central Tank (C1 - Main): The largest, located at the center of gravity of the hull (approx. 2200 L). This is where the engine draws fuel directly from.
Wing Tanks (W1/W2): Integral tanks inside the wing structure (approx. 700 L total).

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2. Fuel as a Coolant System
In the EJ200 system, the fuel circulates in a loop, absorbing heat:
Heat exchangers: Fuel flows through engine oil and hydraulic coolers.
Advantage: Heated fuel burns better, and we save on heavy, external air coolers.

3. Architecture and Security
Jet Pumps: These pump fuel from the wings and nose to the center tank as it is used, keeping the plane from "nosing up."
Inerting System (OBIGGS): Displacement of fuel vapors with nitrogen (generated on board), which prevents the tanks from exploding in the event of a hit or failure.
Pressurised refuelling: Single fill point (NATO standard) allowing you to refuel 3200 kg of fuel in less than 5 minutes.
Fuel parameters table:
Parameter Value Notes
Fuel Weight (Internal) 3,200 kg Approx. 4,000 liters Jet A-1
Flight time (Combat) 45 - 60 min With intensive use of afterburner
Transfer speed 1200 kg/h Main pump capacity
Tank material: Composite/Titanium Self-sealing coatings (optional)

## *Here are the technical details of the wings:*

***For the 15-meter prototype with the EJ200 engine and canard configuration, the main wings must work in conjunction with the forward tailplane to ensure***

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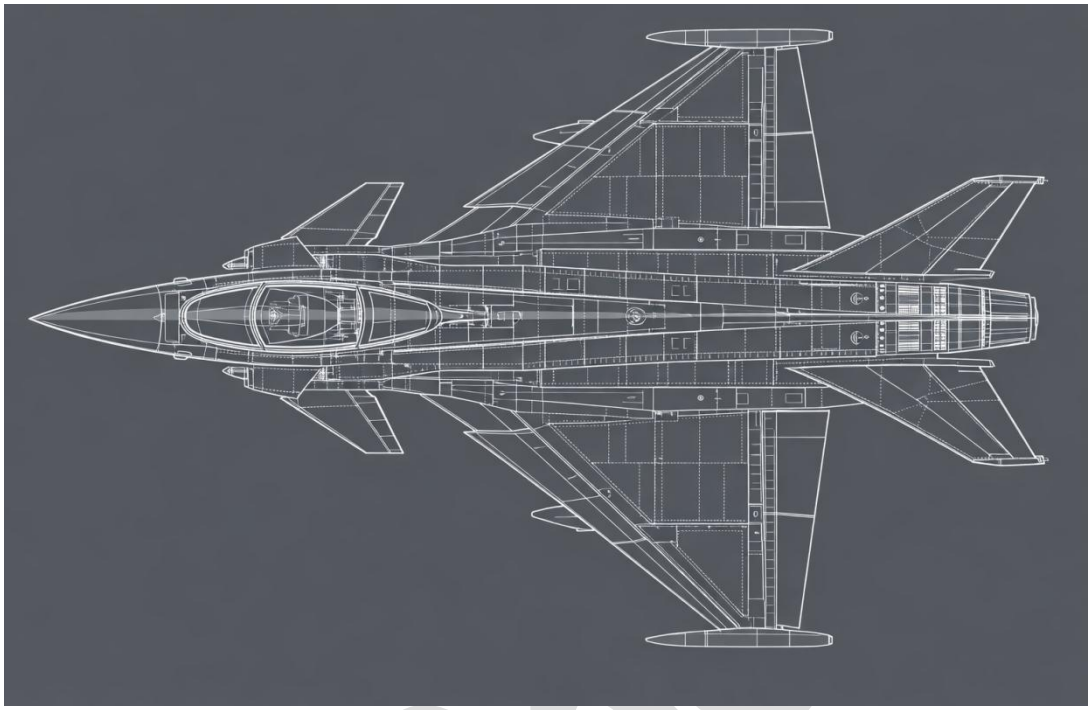
***stability at supersonic speeds. We choose either a variable-sweep Delta (Cranked Arrow) or a Clean Delta, which works best with a 45° canard configuration.***



1. Geometry and Dimensions
Span: 9.2 m.
Supporting surface: 30 m².
Leading edge sweep: 52° (optimal for Mach 1.6+ and EJ200 engine).
Profile: Supercritical, thin (4-5% of relative thickness) to minimize wave drag.

2. Wing Mechanization
Elevators: Divided into two sections on each wing, they work with the V-tail for roll and pitch.
Leading Edge Flaps: Automatically deployed by the Fly-by-Wire system depending on the angle of attack.
No classic flaps: In the canard configuration, the lift on landing is increased by changing the angle of the canards and main wings.

3. Construction and Materials
Main spars: 3 pieces per wing, made of milled titanium, passing through the fuselage (center wing).
Cover: Multi-layer carbon composite (CFRP) with a honeycomb structure.
Integral tanks: The interior of the wings is sealed and holds approximately 700 liters of fuel (W1/W2).

4. Strength Parameters
Breaking Load: +13.5G / -4.5G (designed for 9G operational).

Torsional stiffness: Very high to avoid flutter (vibration) at supersonic speeds generated by the EJ200's 90 kN of thrust.
Wing Dimensions Table:
Parameter Value Notes
Wingspan 9,200 mm Integrated tips (Winglets optional)
Ciosewa (root chord) 4 800 mm Width at the base of the hull
Leading Edge 52 degrees Balance between maneuverability and speed
Wing weight (set) 850 kg Structure + mechanization + installations

## *Here are the technical details of the duck circuit:*

***In the 15-meter prototype with the EJ200 engine, the canard configuration is crucial for supersonic maneuverability. With the heavy engine at the tail, the front wings must generate significant lift to keep the nose up.***

1. Geometry and Placement
Location: 3.2 m from the tip of the nose, just behind the pilot's cabin, above the line of the main wings (high-canard arrangement).
Span: 3,400 mm.
Area: approx. 2.2 m².
Leading edge sweep: 55° (larger than the main wings, for better performance at high angles of attack).

2. Mechanics and Controls (All-Moving Canard)
Full mobility: The wings have no flaps – they rotate completely around their axis by +/- 25°.
Propulsion: Powerful hydraulic actuators (4000 PSI pressure) controlled by Fly-by-Wire.
Aero-brake function: When landing, the canards can swing almost vertically, acting as a powerful air brake, which shortens the landing roll.

3. Role in Aerodynamics
Vortex Generation: The Duck creates vortices of air that "stick" the downdrafts to the main wings, preventing stalling during sharp turns.
Stabilization: Combined with the 45° butterfly tail, the canards allow for rapid changes in flight direction without loss of energy.

4. Construction
Pivot axis: Solid titanium beam passing through the fuselage power frame.
Material: Multi-layer carbon composite (BMI) resistant to supersonic vibrations.
Duck parameters table:
Parameter Value Notes
Span 3,400 mm Integrated with the FbW system
Symmetrical, thin profile Optimal for supersonic Mach 1.8
Rotation speed 60° / second Lightning-fast response to stick movement
Weight (complete with drive) 140 kg Titanium axle + composite panels

# *Butterfly tail*

***In the 15-meter-long prototype with the EJ200 engine, a 45° V-tail is key to low drag and high maneuverability. In this arrangement, two surfaces do the work of four (replacing the traditional vertical and horizontal stabilizers).***

Here are the technical details of the butterfly system:

1. Geometry and Function (Ruddervators)
Opening angle: 90° (i.e. 45° from the vertical in each direction).
Vertical height: 2,100 mm.
Top span: approx. 4,100 mm.
Ruddervators: Movable control surfaces at the trailing edge. Fly-by-Wire computer mixes their movements:
Movement in the same direction = Elevator (pitch).
Movement in opposite directions = Rudder (yaw).

2. Construction of the "Hot Section"
Due to the proximity of the EJ200 nozzle (90 kN thrust and afterburner), the tail must be thermally armored:
Anchoring: Titanium girders anchored deep into the W-23 power frame.
Materials: Carbon composite based on BMI resin (resistant up to 250°C) and titanium leading edges.

Top Secret

Shields: Lower tail surfaces coated with a ceramic heat barrier to prevent afterburner jet from "cooking" them.

3. Advantages for Your Prototype
Less drag: Only two surfaces cut through the air instead of three or four.
Clean Flow: The absence of a vertical stabilizer eliminates turbulence over the fuselage, which improves the performance of the EJ200 engine.
Stealth: Sloped surfaces reflect radar waves better than classic vertical stabilizers.
Tail Parameters Table:
Parameter Value Notes
45 degree tilt angle Perfect balance (Mixer 50/50)
Area (total) 7.5 m² Large surface for stability Mach 1.8
Rudder deflection +/- 35 degrees Very aggressive maneuvering
Weight (set) 280 kg Reinforced titanium-BMI structure

## *S-Duct air intakes*

***On the 15-meter-long EJ200-powered prototype, the S-Duct air intakes are the most complex aerodynamic design element. They must deliver 77 kg of air per second, bypassing the cockpit and forward fuel tanks while concealing the compressor blades from radar.***

Here is a detailed technical plan of the inlets:

1. Geometry and Location (Side Inlets)
Type: DSI (Diverterless Supersonic Inlet) supersonic inlets – no moving parts, with a characteristic "bump" that pushes away the boundary layer of air.
Location: On both sides of the single cabin, starting at a height of 4.5 m from the nose.
S-Duct Shape: The ducts curve inward into the fuselage to meet in front of the EJ200 engine nose at 11 meters.
Advantage: The "bend" of the duct makes the engine blades invisible from the front (protection against radar waves).

2. Flow Parameters
Inlet area (each): approx. 0.22 $m^2$ (total 0.44 $m^2$).
Diffusion: The duct widens as it approaches the engine, which slows the supersonic air to subsonic speeds (approx. Mach 0.4-0.5) safe for the EJ200 compressor.
Material: Carbon composite with high internal smoothness (reduced friction and pressure losses).

3. Integration with the Structure
Passing Canards: S-Ducts must pass directly under the canard's axis of rotation.
Cooling: The inner walls of the channels are used to mount small heat exchangers (fuel-air).

4. Technical Data Table:

| Parameter | Value | Notes |
|---|---|---|
| Channel length S | 6,500 mm | From inlet to engine face |
| Mass flow | 77 kg/s | Full power EJ200 engine |
| Pressure recovery efficiency | 0.96 - 0.98 | Minimal losses on "S" bends |
| Weight of the structure (set) | 320 kg | Composite + titanium reinforcements |

## *Here are the specifications of the digital control system*

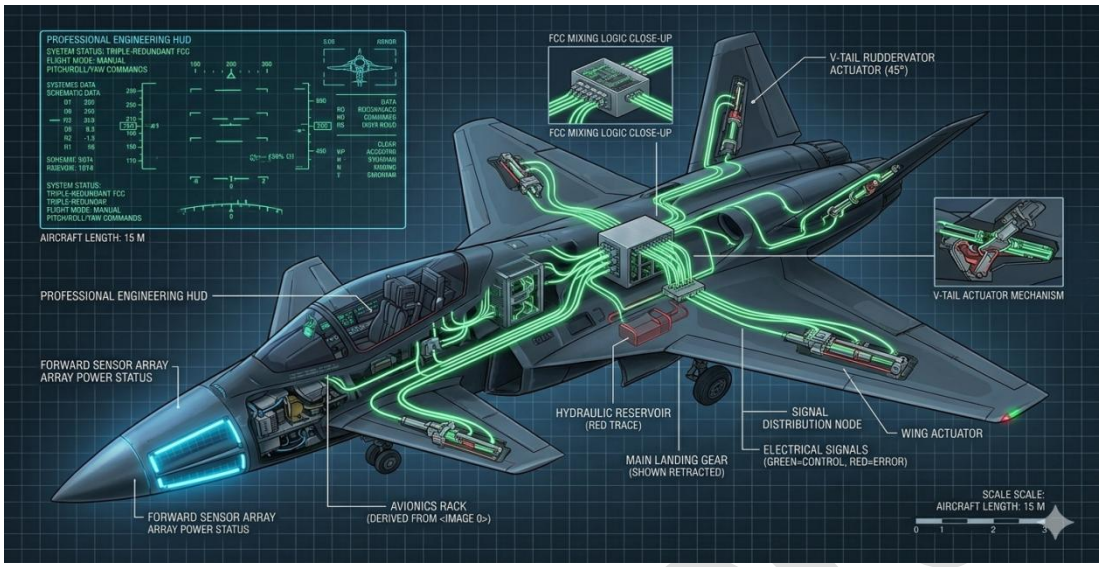
### ***In the 15-meter-long EJ200-powered prototype, the Fly-By-Wire (FBW) system isn't just about control—it's the "brain" that keeps this aerodynamically unstable machine aloft. With a canard configuration and a 45-degree butterfly tail, a mechanical connection between the stick and the controls is physically impossible.***

1. System Architecture (Triplex Redundancy)
3 Independent Channels: Each maneuver is calculated by three computers simultaneously. If one computer gives a different result, the other two "vote" it (Voting Logic).
No mechanical connections: The stick and pedals are just sensors (joysticks) that send electrical signals to hydraulic actuators on the wings, canard and tail.

2. Digital Control Mixer (V-Tail & Canard Control)
The computer must "mix" the surface movements in real time (thousands of times per second):
Longitudinal Axis (Tilting): Simultaneous movement of the Duck (front) and Ruddervators (back).

Top secret

Rolling Axis: The work of the Elevons on the wings and the asymmetric movement of the butterfly tail.
Vertical Axis (Yaw): 45° butterfly tail operation as a rudder.



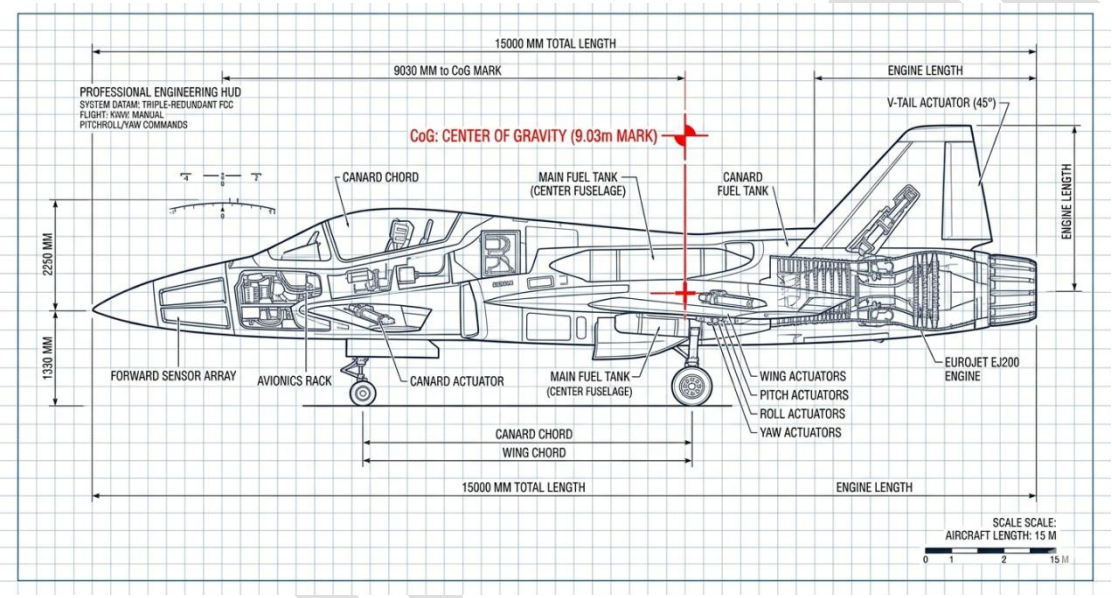

3. Flight Envelope Protection
The FBW system ensures that the pilot does not destroy the machine:
G-Limiter: Even if the pilot pulls the stick all the way, the system will not allow it to exceed +9G / -3G, protecting the titanium structure and the pilot's spine.
AoA Limiter: Prevents stalling. If the airspeed drops too low, the FBW will automatically lower the nose (camber) to regain lift.
Auto-Trim: The aircraft itself maintains the set altitude and heading, correcting the loss of fuel in the tanks.

4. Chassis Integration (Active Gear Sync)
The FBW decides when to send a signal to extend the landing gear legs by 15 cm. It does this based on radio altimeter data and descent rate, preparing the landing gear for a hard touchdown.
FBW Component Table:
Item Quantity Function Weight (kg)
FCC (Flight Control Computer) 3 Computing Units (PowerPC Processors) 30
IMU (Inertial Measurement Unit) 2 Gyroscopes and accelerometers (motion detection) 5
DDV 8 actuators Direct control of hydraulic valves 120
Emergency Batteries (UPS) 2 FBW power supply in case of engine failure EJ200 25

Balance Analysis of a 15-Meter Fighter

Here's the final mathematical analysis of the balance of a 15-meter fighter jet. For the aircraft to be controllable with the fly-by-wire system, the center of gravity (CoG) must be within a strictly defined range (known as static margin).
With the heavy EJ200 engine at the very back, we have to "fight" for every kilogram at the front.

1. Mass and Moment Balance (X-axis: 0.0m = Tip of the Nose)
We calculate the moments (Mass × Distance from the nose) to determine the support point.
Element Mass (kg) Position (m) Moment (kg m)
Radar and Forward Ballast 250 0.8 200
Duck System (Mechanism) 140 3.2 448
Cabin + Pilot + Seat 0-0 350 3.8 1 330
Fly-by-Wire Electronics 80 4.2 336
Front Tank (F1) 400 5.5 2 200
Central Tank (C1) 2,200 8.2 18,040
Main Wings + Fuel 1,550 10.5 16,275
Main Landing Gear 550 9.4 5 170
Eurojet EJ200 engine 1,035 13.2 13,662
V-Tail 45° 280 14.5 4,060
TOTAL (Takeoff Weight) 6,835 kg COG RESULT 61,721 kg·m



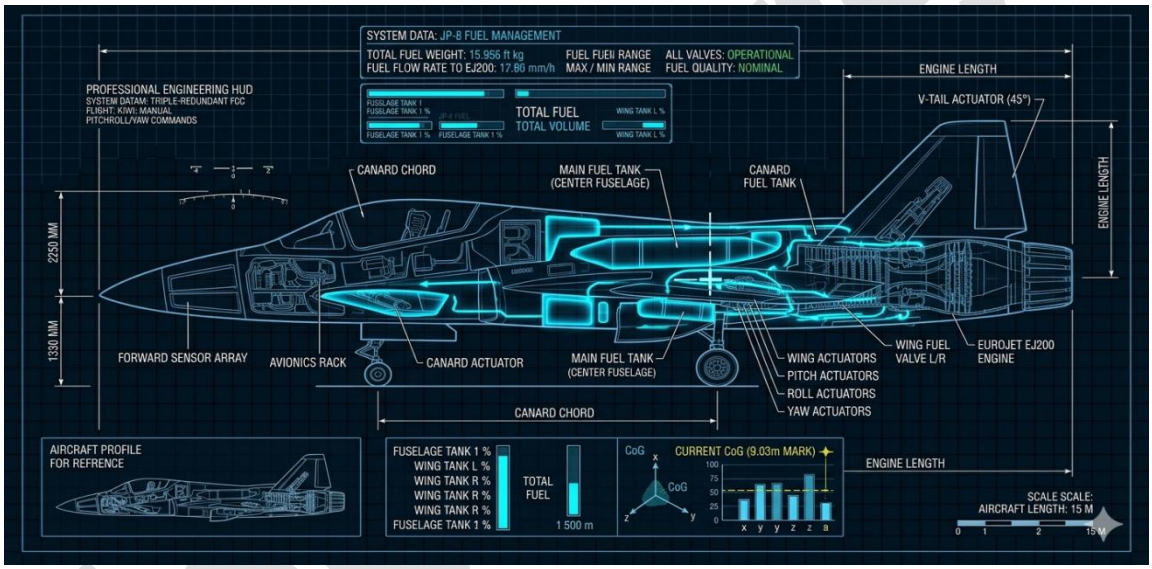

2. Analysis Result: Center of Gravity (CoG)
We divide the sum of moments by the sum of masses:
Designated Centre of Gravity: 9.03 m from the nose.
Technical interpretation:
Aerodynamic neutral point: approx. 9.45 m.
Static margin: 42 cm (approximately 3% of length). This is ideal for a supersonic fighter. The aircraft is slightly unstable (easily initiating turns), which the FBW system translates into incredible maneuverability.

3. Critical Geometric Data (Numbers)
Total length: 15,000 mm.
CoG Position (Empty): 9.25 m (rear escape through engine).
CoG (Full): 9.03 m (F1 fuel adds weight to the front).
Chassis Track: Front axle 2.5 m; main axle 9.45 m.
Note: The main landing gear must be 42 cm behind the CoG to prevent the aircraft from tipping over on its tail when the pilot boards.

4. Active Balance System (Fuel Consumption)
The FMS system must ensure that the fuel in the F1 (front) tank does not disappear too quickly.
If the F1 is emptied ahead of the wings, the CoG will move back 9.35 m.
Risk: The aircraft will become too agile ("nervous") for the pilot.
Solution: The system always maintains a minimum of 150 kg of fuel in the F1 as ballast until landing approach.

# *Here is the Active Digital Balance System (ACBS) project:*

## *In the 15-meter-long prototype with the EJ200 engine, the Fuel Management System (FMS) must act as a digital ballast. With such a heavy tail and canard configuration, any change in fuel load drastically shifts the center of gravity (CoG).*




1. Flow Architecture (Combustion Sequence)
The system controls the pumps to maintain the CoG at a constant point (approx. 9 meters), regardless of maneuvers:
Phase 1 (Takeoff/Climb): Fuel is drawn first from the wings (W1/W2) to lighten the load-bearing structure.
Phase 2 (Cruise): The front tank (F1) is emptied. As the front becomes lighter, the Fly-by-Wire computer corrects the canard angle.
Phase 3 (Combat/Afterburner): Fuel is drawn from the central tank (C1). This is the "heart" of the system, and must always be powered to prevent the EJ200 from stalling under 9G acceleration.

2. Digital Balance Controller (FMC)
Ultrasonic sensors: Each tank is equipped with sensors that measure the fuel level with an accuracy of 1 liter, even when tilted.
Automatic re-pumping: If the nose becomes too heavy, the system transfers 100 kg of fuel to the center section in 3 seconds to restore perfect balance.

3. Ullage & G-load System
Collector Tank: A small, 50-liter tank inside the C1, always full and fed by plunger pumps, keeps the EJ200 engine running in inverted (wheels up) flight for approximately 30 seconds.
Inerting (OBIGGS): As fuel is used up, the empty space is filled with nitrogen, eliminating the risk of a vapor explosion.

4. System Logic Table:
Flight Status System Action Effect on CoG
Start (Full) Wing intake Stable (central)
Supersonic Pumping to F1 (nose) Forward displacement (stability)
Landing (Remnants) Maximum focus in C1 Stable (over landing gear)

## *Improvements required*

### *Here is the final report with the detected nuances that we need to address before construction:*

1. Verification of Dimensions and Weight (Final Balance)
Fuselage (15 m): With this length and one EJ200 engine, the fuselage has to be very slim (approx.
1.45 m wide) to maintain the principle of fields (reduction of supersonic drag).
Weight (MTOW approx. 8.6 t): This places your aircraft squarely between the Gripen (lighter) and the F-16 (heavier). It's the perfect "featherweight" for a 90 kN engine – giving it an incredible thrust-to-weight ratio of 1.05+.

2. Critical Point: S-Duct (Intakes) vs Canards
Analysis: The air intakes start at 4.5 m and the canard rotation axis is at 3.2 m.
Verdict: The canard's rotation mechanism must be either hollow or bypass the air intake ducts. This is a challenging engineering task, but feasible using a titanium swivel ring around the S-Duct.

3. Chassis System (+15 cm) – Stress Analysis
Analysis: Since the landing gear "stiffens" before touchdown, all the impact energy goes directly to the W-16/17 frames.
Correction: We need to add "dissipative stringers" (longierons) that will transmit the impact from the landing gear along the entire length of the fuselage, not just to one point, otherwise in a hard landing the fuselage could break in half behind the cabin.

4. Determining the Center of Gravity (CoG) – Final Numbers
CoG position: 9.03 m from nose.
Main landing gear: 9.45 m from the nose (safe margin of 42 cm to prevent tail-sitting).
Ballast Tank: The fuel system must always leave a reserve in the forward tank (F1) to prevent the aircraft from becoming aerodynamically uncontrollable when the tank is empty.5. 45° Butterfly Tail vs EJ200

Top Secret

Thermal Analysis: The EJ200's afterburner "spits" flame several meters away. At a 45° angle, the ruddervators' edges are susceptible to thermal erosion.
Recommendation: The lower 30 cm of each V-tail fin must be coated with a layer of technical ceramic (Zirconia).

# *Generally*

***F18 M1 ARGO PT1 (SPEARHAWK) The 15-meter prototype with the EJ200 engine is a machine that behaves like a "surgical scalpel" in the air - it is extremely fast, but thanks to the canard system and digital Fly-by-Wire, it maintains incredible agility.***

Here is an in-depth performance analysis in the words:

1. Start and Acceleration Dynamics
With a thrust-to-weight ratio exceeding 1:1 in afterburner, the aircraft doesn't require a long takeoff roll. After releasing the brakes at full power of 90 kN, it presses the pilot back into the seat, reaching rotational speed in seconds. Just before liftoff, the Active Stiff-Extender system shortens the wings to the working position, and the canard rapidly raises the nose, allowing for a near-vertical climb just beyond the runway threshold.

2. Supersonic Characteristics (Supercruise)
The EJ200 engine enables supercruise, flight at supersonic speeds (around Mach 1.2) without the use of afterburner. With a 15-meter-long, slender fuselage, wave drag is minimal. After engaging the afterburner, the aircraft instantly breaks the sound barrier, reaching a maximum speed of around Mach 1.8-2.0. The 45° butterfly tail reduces interference drag, making the flight exceptionally stable even under extreme dynamic pressure.

3. Maneuverability and "Wheel Fighting"
The canard configuration, combined with the delta wing, makes the aircraft "controllably unstable." This means it can change direction almost on the spot. During tight turns at 9G, the front wings generate powerful air vortices that prevent the main wing from breaking up. The butterfly tail allows for simultaneous rapid rolls and loops without the risk of a spin.

4. Low Speed Stability and Landing
This is where the systems truly shine. Although the wing profile is optimized for supersonic flight, the canard "draws" lift during landing approach. At an altitude of 10 meters, the Fly-by-Wire system sends a signal to the landing gear, stiffening the landing gear and extending it by 15 cm. This allows the pilot to land with a high angle of attack (High AoA) without the risk of tail strike, minimizing the landing roll.
Performance Summary (Numerical):
Climb speed: approx. 250 m/s (vertical take-off).
Turning radius: One of the smallest in this weight class (thanks to the canards).
Operational ceiling: 16,000 m (stratosphere).
Thermal efficiency: The fuel cooling system allows for long-term supersonic speed maintenance without overheating the hot section.

## *Prompt*

Prompt: Orthographic 3-view drawing of a 15m long jet fighter, canard configuration, V-tail 45 degrees. Dimensions labeled in millimeters. Single engine Eurojet EJ200 visible in rear. Transparent fuselage showing internal fuel tanks and engine placement. Professional aerospace engineering blueprint style, high contrast, technical annotations, 8k.

Prompt: Internal structural X-ray of a 15-meter jet fighter. High-detail view of the titanium skeleton, blue-tinted ribs, and 4 main longerons. Single Eurojet EJ200 engine mounted at the rear wręga W23. Canard mechanism at the front, large delta wing spars in the middle. 45-

degree V-tail titanium supports. Clear fuel tanks in the center. Professional aerospace engineering blueprint, 8k resolution, cinematic lighting, sharp technical details.

Prompt: Futuristic fighter jet with canards and 45-degree V-tail in high-speed flight. Blue afterburner flame from Eurojet EJ200 engine. 15-meter long slender fuselage. Clouds in the background, motion blur, realistic lighting, dramatic sky, 8k, highly detailed aerospace photography.

Prompt: Side profile of a sleek supersonic prototype aircraft, 15 meters long, canard wings near the nose, main wings at the back, 45-degree V-tail butterfly system. Massive exhaust of Eurojet EJ200 engine. Single pilot canopy. Metallic carbon fiber skin, stealth grey paint. Concept art, realistic, hangar background, sharp edges, futuristic design.

Prompt: Technical blueprint, 3D cutaway view of a 15-meter long single-engine jet fighter, canard wing configuration, V-tail angled at 45 degrees. Rear-mounted Eurojet EJ200 engine visible. Internal titanium skeleton, ribs and spars, single-seat cockpit at the front. High-tech, aerospace engineering style, white background, detailed mechanical parts, 8k resolution, cinematic lighting.

Prompt: Technical X-ray view of a fighter jet rear section, focus on Eurojet EJ200 engine mount. Visible titanium blue-tinted ribs, glowing orange Inconel heat shields, carbon fiber textured outer skin. V-tail 45 degree assembly with honeycomb core visible. Detailed engineering aesthetics, blueprint style, high tech materials, 8k resolution.

Prompt: Technical schematic of a jet aircraft cooling system, 15-meter fuselage, internal view. Highlighting blue liquid cooling lines (fuel lines) and red heat dissipation zones around the Eurojet EJ200 engine. NACA ducts on the sides, heat exchangers near the wing roots. 45-degree V-tail with thermal protective layers. Professional engineering infographic style, 8k, blueprints.

Prompt: Detailed 3D technical render of a fighter jet landing gear, telescopic hydraulic strut extending by 15cm. Visible heavy-duty steel 300M pistons, high-pressure hydraulic lines, orange stiffening valves. Mechanical close-up, blueprint background, aerospace engineering precision, 8k resolution, cinematic lighting.

Prompt: Modern single-seat fighter cockpit interior, large area touchscreen display (LAD) glowing with flight data, holographic Head-Up Display (HUD). Side-stick controller on the right, ergonomic throttle on the left. High-tech carbon fiber panels, green and blue ambient lighting. View through the canopy showing canard wings. Hyper-realistic, 8k resolution, aerospace aesthetics.

Prompt: Close-up of a small emergency ram air turbine (RAT) deployed from the side of a sleek grey jet fighter fuselage. High-speed spinning blades, mechanical actuators, hydraulic lines visible. 15-meter aircraft in the background. High-tech engineering detail, cinematic lighting, 8k resolution.

Top Secret

Prompt: Extreme action shot of a zero-zero ejection seat firing from a 15-meter grey jet fighter. Rocket exhaust flame under the seat, canopy shattered into fragments, pilot in green flight suit being propelled upwards. Detailed mechanical parts of the seat, 45-degree V-tail and canard wings visible in the blur. Cinematic, 8k, high-speed photography style.

Prompt: POV from a single-seat fighter pilot's perspective, 15m jet with canards visible through the canopy. Large panoramic digital touchscreen (LAD), side-stick on the right, heavy-duty throttle on the left. High-tech carbon fiber interior, green glowing HUD. Futuristic, ergonomic, 8k resolution, cinematic lighting, sharp details.

Prompt: Extreme close-up of a Eurojet EJ200 turbofan engine, industrial aerospace photography. Visible multi-stage compressor blades, carbon fiber casing, and complex hydraulic lines. Rear section showing the convergent-divergent exhaust nozzle with titanium petals. High-tech engineering aesthetic, mounted on a heavy-duty steel test stand, dramatic workshop lighting, 8k resolution, photorealistic, sharp focus.

Prompt: Technical cutaway of the rear section of a 15-meter jet fighter. Internal placement of the Eurojet EJ200 engine. Visible blue-tinted titanium main ribs and Inconel heat shields surrounding the afterburner chamber. Detailed S-duct air intake connecting to the engine front. The 45-degree V-tail structure is attached to the main fuselage frame. Cinematic lighting, blueprint style, detailed mechanical components, 8k.

Prompt: Close-up of a jet fighter exhaust nozzle, Eurojet EJ200 engine at full power with blue and orange afterburner flame. Glowing titanium petals, heat shimmer effect, 45-degree V-tail fins visible on the sides. Night-time runway background, intense light, sparks, realistic textures, high-speed shutter photography, 8k resolution.

Prompt (Przekrój): Technical 3D X-ray view of a 15-meter jet fighter, showing internal fuel tank network. Large central fuselage tank, wing tanks, and forward balance tank highlighted in translucent blue. Fuel lines connecting to the rear Eurojet EJ200 engine. 45-degree V-tail and canard configuration visible. Aerospace engineering schematic, 8k, high detail.

Prompt (Tankowanie): Close-up of a high-pressure fuel port on a sleek grey jet fighter fuselage. Ground crew connecting a heavy-duty fuel hose. 15-meter aircraft with canard wings in a hangar. Realistic lighting, industrial aerospace setting, 8k resolution.

Prompt (Widok z góry): Top-down technical view of a 15m jet fighter, canard configuration, large delta wings with 52-degree sweep. 45-degree V-tail butterfly system. Visible panel lines of carbon fiber skin. Eurojet EJ200 exhaust at the rear. Aerospace engineering blueprint style, 8k, sharp lines, grey background.

Prompt (Detale mechanizacji): Close-up of a jet wing leading edge flaps and elevons moving during flight. Carbon fiber texture, titanium actuators. 15-meter fuselage in the background, sleek aerodynamic design. High-speed photography, motion blur, 8k resolution, cinematic lighting.

Top Secret

Prompt (Widok z przodu): Front view of a 15-meter sleek jet fighter, prominent all-moving canard wings near the cockpit. Large delta wings behind, 45-degree V-tail butterfly system. High-tech carbon fiber skin, sharp aerodynamic lines. Single-seat canopy visible. Daytime sky background, 8k resolution, cinematic lighting.

Prompt (Detale mechanizmu): Extreme close-up of a titanium actuator rotating a canard wing on a jet fighter fuselage. Detailed mechanical hinges, panel lines, 15-meter aircraft in the background. Industrial aerospace photography, sharp focus, 8k, realistic lighting.

Prompt (Widok od tyłu): Rear-view of a 15-meter jet fighter, Eurojet EJ200 engine nozzle glowing with blue afterburner. Prominent V-tail butterfly system angled at 45 degrees. Sleek aerodynamic tail section, titanium heat shields, carbon fiber texture. 8k, cinematic lighting, aerospace engineering photography.

Prompt (Akcja sterów): Close-up of a jet's V-tail ruddervators moving asymmetrically during a high-G turn. 45-degree angle, sharp mechanical details, heat shimmer from the exhaust. 15-meter fuselage in perspective. Hyper-realistic, 8k resolution, sharp focus.

Prompt (Widok z przodu/skosu): Close-up of a 15-meter jet fighter's air intakes, DSI (diverterless) design with a smooth bump on the side of the fuselage. Sleek grey composite skin, single-seat cockpit visible. Leading edge of canard wings above the intake. High-detail aerospace photography, 8k, cinematic lighting.

Prompt (Przekrój S-Duct): X-ray technical view of a 15m jet fighter showing the internal S-duct air intake curving around the cockpit and fuel tanks to reach the rear Eurojet EJ200 engine. Smooth carbon fiber internal tunnels. Engineering schematic, 8k resolution, blue and white highlights, sharp details.

Prompt (Serce systemu): Technical close-up of a triple-redundant flight control computer (FCC) rack inside a jet's nose section. Glowing green fiber-optic cables, high-density processors, aluminum cooling fins. Visible labels "FLY-BY-WIRE SYSTEM". Aerospace electronics, 8k, cinematic lighting.

Prompt (Miksowanie sterów): Animated-style technical diagram showing a jet with canards and 45-degree V-tail. Glowing neon lines representing electrical signals from the cockpit to the wings and tail actuators. Professional engineering HUD overlay, dark background, 8k.

Prompt: Engineering blueprint of a 15-meter jet fighter, side view. Canard-delta wing configuration, 45-degree V-tail. Eurojet EJ200 engine at the very rear. Internal components visible: cockpit, fuel tanks, engine. A bright red crosshair marking the Center of Gravity (CoG) at the 9.03-meter mark. Technical annotations, dimensions in millimeters, white background, black and blue technical lines, 8k resolution, ultra-detailed.

Prompt (Schemat dynamiczny): Digital technical display of a fuel management system for a 15m jet. Neon blue lines showing fuel flow from wing tanks to the Eurojet EJ200 engine. Central computer interface with graphs and Center of Gravity indicators. High-tech HUD style, aerospace engineering software, 8k.

Top Secret

Prompt (Pompy i zawory): Extreme close-up of high-speed aircraft fuel pumps and stainless steel valves inside a dark fuselage section. 15-meter jet fighter structure visible in the background. Industrial engineering photography, sharp focus, 8k resolution, cinematic lighting.

Prompt (Iron Bird): A 15-meter jet fighter skeleton inside a laboratory hangar, surrounded by hydraulic actuators and steel frames. Glowing wires and blue hydraulic lines everywhere. Engineers in white coats monitoring screens. High-tech aerospace testing facility, cinematic lighting, 8k resolution.

Prompt (Drop Test): Action shot of a sleek jet fighter being dropped onto its landing gear in a test facility. Dust clouds, high-speed camera setup, heavy steel cables. Visible 15cm extension of the landing gear struts. Hyper-realistic, engineering precision, 8k.

Prompt: A professional high-detail 3D render of the Polish air superiority fighter "F18 M1 ARGO". 15 meters long, sleek aerodynamic fuselage, single-seat cockpit, canard-delta configuration, 45-degree V-tail butterfly system. Powered by a Eurojet EJ200 with blue afterburner flame. Stealth charcoal grey skin with Polish Air Force checkers (Szachownica). Active landing gear extended by 15cm. Cinematic lighting over a high-tech hangar, 8k resolution, aerospace engineering masterpiece.

Prompt: Final technical masterpiece of a 15-meter single-engine jet fighter, polish aerospace engineering project. Features: Canard-delta configuration, 45-degree V-tail butterfly system, Eurojet EJ200 engine exhaust. Sleek aerodynamic fuselage with S-duct air intakes. Active landing gear extended by 15cm. 3-view orthographic blueprint style, visible internal titanium ribs and fuel tanks. Center of Gravity (CoG) marked at 9.03m. Stealth charcoal grey skin, high-tech avionics cockpit, 8k resolution, cinematic lighting, professional aerospace schematic.

Top Secret